NOTE ON STEINMANNELLA (YEHARELLA) AINUANA
(YABE AND NAGAO)*

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Steinmannella (Yeharella) ainuana (YABE and NAGAO) is well characterized by its outline and surface costation and characteristic in the Northern Pacific region possibly from upper Albian to Maestrichtian. Trigonia ainuana is a typical Steinmannella (Yeharella) and has been originally described by YABE and NAGAO (1928) from the "Trigonia Sandstone" (Cenomanian-Turonian) of Pombetsu in Ikushumbetsu, Mikasa-city, Central Hokkaido. Recently, the writer had an opportunity to study the Cretaceous rocks of the Ikushumbetsu district and collected numerous specimens of Steinmannella (Yeharella) ainuana from various places. As a result, it is recognized that St. (Y.) ainuana represents a remarkable change of characters in ontogeny and this species shows a certain degree of variation.

The materials dealt here with were collected by T. MATSUMOTO and the writer from the Ikushumbetsu district, Central Hokkaido and stored in the Geological Institute of Kyushu (GK) and Hiroshima (GH) Universities.

The writer wishes to express his sincere thanks to Prof. Sotoji IMAURA of Hiroshima University. His thanks are due to Prof. Teiichi KOBAYASHI of the University of Tokyo, Prof. Tatsuro MATSUMOTO and Mr. Ikuko CHATA of Kyushu University, Messrs Tomowo OSE and Ichiro HAYASHI of the Sumitomo Colliery Company, and Emer. Prof. Sho-shiro HANZAWA of Tohoku University for their assistances.

Family Trigoniiidae LAMARCK, 1819

Subfamily Quadratotrigoniinae

SAVELIEV, 1958

Genus Steinmannella CRICKMAY, 1930

Type species:—Trigonia holubi KITCHIN, 1913. Up. Neocomian; Natal, South Africa.

Synonym: — Transitrigonia DIETRICH, 1933.

Remarks: — The writer here accepts KOBAYASHI and AMANO'S proposal. This genus varies to a large extent in surface sculpture and shell form, and comprises 3 subgenera and a number of species and varieties as listed by them (1955) and NAKANO (1960). 

Subgenus Yeharella KOBAYASHI and AMANO, 1955

Type species:—Trigonia japonica YEHARA, 1923. Campanian: Sanuki and Iyo, Japan.

Diagnosis:—Shell large in size, subquadrate to triangularly ovate; umbo impromptent; beak opisthogyrus and pointed anteriorly; escutcheon depressed, with transverse costellae which are effaced later; area ornamented with tuberculate costellae at least near umbo but in the later stage costellae become obsolete; carinae absent but sometimes a row of nodes aligned in place of three carinae in the vicinity of umbo; median furrow shallow and rather indistinct. separates a broad anteal part from a narrow posteral flank with tuberculate costae or rows of nodes which are disposed subconcentrically or diagonally.

Test thick; growth-lines somewhat distinct on the whole surface.

Remarks: — As pointed out already by KOBAYASHI and AMANO, this subgenus is easily distinguishable from the others of Steinmannella by the effacement of the transverse costellae and the carinae on the area. The specific list of the subgenus was given by them (1955) and NAKANO (1960).

The shell belonging to this subgenus shows a remarkable morphic change through growth.

The immature shell of this subgenus is subcircular to ovate in outline and quite similar to that of Myophorella s.s. in surface costation. The beak is anteromesial to subcentral. Its area is provided with transverse to oblique costae, and distinctly bordered by three rows of nodes. Median furrow is shallow but distinct. Costae on the flank are tuberculate or broken into rows of nodes.

In the later stages, the shell becomes gradually trigonally ovate or subquadrate in shape and the beak is shifted antecially. The carinae and sculpture on the area are obsolete, and the median furrow is generally indistinct. The flank is ornamented with numerous tuberculate costae or rows of nodes which are disposed subconcentrically or diagonally.

Growth-lines are somewhat distinct on the whole surface through growth, especially in the posterior part of the later stages. Internally, weak radial plications run along the positions of the carinae and ventral margin is smooth. As pointed out by KOBAYASHI and AMANO (1955, p. 200), in some internal moulds of the right valve (pl. 20, figs. 3 and 5) it is also well observed that several grooves and ridges behind the posterior adductor scar and they are oblique to the margin.

The shell outline and the surface costation are fairly variable in this subgenus. The outline is subquadrate in ainuana, kinurai and others, but subtrigonal in fitchi, japonica and its variety obsolata etc. Leana has a subcircular shell, but some forms of ainuana are somewhat trapezoidal. Costae on the flank are
arranged subconcentrically in *japonica* and its ally, while they are diagonal in common forms. Costation on the area and escutcheon are indistinct in most others, but the sculpture is fairly distinct in some forms (pl. 21, fig. 4) of *ainuana*. Nodose carinae developed in *japonica* and *kimurai* etc., while they are obscure in most common forms. A median furrow is often distinct, but indistinct in common forms. PACKARD'S *leona* (pl. 5, figs. 1 and 5) has a wide area, almost as large as the flank, but in most others it is nearly as wide as a third of the flank.

**Distribution:** Upper Albian (?) to Maastrichtian in the Northern Pacific region. As already discussed by the writer (1958), in Japan this subgenus appeared probably in the Cenomanian of the Yezo geosynclinal region including Hokkaido and Sachalin district, and flourished mainly in the Upper Cretaceous of Southwest Japan.

**Steinmannella (Yeharella) ainuana**

(YABE and NAGAO)

Pl. 20. Figs. 1-6: Pl. 21, Figs. 1-6.


**Material:** Holotype (YABE and NAGAO's original specimen) from Pombetsu in Ikushumbetsu, Mikasa-city, Central Hokkaido. The fairly well preserved specimens which the writer has examined are as follows:

In M. NAKANO's collection, from M. NAKANO's horizon U, (see 1960, p. 223, tab. 1) of the *Inoceramus hobetsensis* zone in the upper "Trigonia Sandstone" at an old site of a quarry near the Katsurazawa-dam in Ikushumbetsu, Mikasa-city (GH. NM. 1081-1095, 1097 and 1099). GH. NM. 1096 and 1098 were collected from M. NAKANO's L$_2$ horizon (see 1958, p. 224, tab. 2) of the *Catycoceras* zone (?) in the lower "Trigonia Sandstone" along the Pombetsu river in Ikushumbetsu, Mikasa-city.

In T. MATSUMOTO's collection, GK. H. 6046, 6047 and 6053a-b were collected from the upper "Trigonia Sandstone" at T. MATSUMOTO's loc. IK-2015 along the Pombetsu river in Ikushumbetsu, Mikasa-city and GK. H. 6054 was collected by K. SATO from the *Inoceramus hobetsensis* zone of the upper "Trigonia Sandstone" at the point (F) of 138.60 m in No. 1 tunnel of the Katsurazawa-dam in Ikushumbetsu. Besides them the writer observed numerous unregistered materials from the same locality, collected by T. MATSUMOTO.

**Description:** Shell large in size, ovately subtrapezoidal to trigonally ovate, inequilateral, broader than high and gently convex from umbo to venter and from anterior to posterior but obtuse carinal angulation developed in the boundary between the flank and the area: antero-dorsal margin short and nearly straight or slightly convex, forming an angle of 95 to 115 degrees against with postero-dorsal margin; antero-ventral rounded and transmitting gradually into broadly arched ventral; postero-dorsal nearly straight or a little convex, about a half as long as shell; siphonal margin gently curved and well rounded but sometimes subangulated at junction with dorsal or ventral margin. Umbo low and rather improminent; beak opisthogyrous and pointed at about a fifth
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to three-tenths from the front. Flank with about 17 nodose costae or rows of nodes which are subvertical near the area and become thicker towards ventral periphery where nodes are somewhat elongated along growth-lines; umbonal about 2 tuberculate costae concentric to subconcentric; succeeding some 10 nodose costae or rows of nodes more or less broadly spaced and curved diagonally: last 5 or so rows of nodes, slightly curved, oblique forward and arranged diagonally. Carinae obscure, but in the early stage a row of nodes aligned in place of the carinae. Area smooth except for the umbonal region with numerous tuberculate costae, almost as large as a third of the flank and distinguishable from the flank by an abrupt change of curvature and absence of nodes. Median furrow well observed in the vicinity of umbo where the area is divided into a broader anteal and a narrower posteal part by it, but in the later stage it becomes obscure. Escutcheon narrow, somewhat depressed, provided with numerous slightly tuberculate costellae which are evanescent later.

Growth-lines somewhat distinct on whole surface, especially in posterior. Internally, weak radial plications run along the positions of carinae and very thickened at the ventral periphery. Ventral margin smooth. Test thick and its thickness measures about 5 mm. in common adult forms.

Measurements in mm.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Valve</th>
<th>Length</th>
<th>Height</th>
<th>L/H</th>
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<tr>
<td>GH NM. 1081</td>
<td>Right</td>
<td>76.0</td>
<td>68.0</td>
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<td>GH NM. 1082</td>
<td>Right</td>
<td>74.2</td>
<td>65.2</td>
<td>1.14</td>
</tr>
<tr>
<td>GH NM. 1083</td>
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<td>58.3</td>
<td>48.0</td>
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<tr>
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<td>65.4</td>
<td>57.2</td>
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<tr>
<td>GH NM. 1098</td>
<td>Left (internal)</td>
<td>74.5</td>
<td>64.8</td>
<td>1.15</td>
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<tr>
<td>GH NM. 1094</td>
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<td>72.1</td>
<td>62.9</td>
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<td>55.5</td>
<td>1.12</td>
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<tr>
<td>GH H. 6051</td>
<td>Bivalved</td>
<td>83.4</td>
<td>68.0</td>
<td>1.23</td>
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</table>

Explanation of Plate 20

Steinmannella (Yekovella) ainuana (YABE and NAGAO) ........................................... p. 141

Figs. 1a-b. Bivalved specimen (GH H. 6051). Adult stage. Loc. point of 138.60 m. in No 1 tunnel of the Katsurazawa-dam, Ikushumbetsu, Mikasa-city. Central Hokkaido.

Fig. 2. Modeling cast of an imperfect right valve (GH H. 6053b), showing surface character of the area. Middle stage. Loc. T. MATSUMOTO's loc. IK 2015 along the Pombetsu river in Ikushumbetsu.

Fig. 3. Internal mould of a right valve (GH H. 6047). Early adult stage. Loc. ditto.

Fig. 4. Internal mould of a right valve (GH NM. 1084), showing internal character. Middle stage. Loc. an old site of a quarry near the Katsurazawa-dam in Ikushumbetsu.

Fig. 5. Imperfect left valve (GH NM. 1085), showing surface costation and coarse growth-lines. Middle stage. Loc. ditto.

Fig. 6. Imperfect right valve (GH NM. 1086a), showing internal character in the immature stage. Adult stage. Loc. ditto.
NAKANO: Steinmannella (Yeharella) ahuana

Plate 20
Remarks:—The ontogenetic change is remarkable in this species. In the early stage, the shell (L=25–35 mm., H=23–32 mm.) is circular to subcircular in outline and the beak located at about two-fifths from the front but sometimes subcentral. The height-length proportion ranges 1:1.03 to 1:1.10. The surface costation of this stage is quite similar to that of Myoporella s.s. Flank is sculptured with about 11, moderately spaced, nodose costae or rows of nodes which are arcuate diagonally. Carinae are absent, but a row of nodes is aligned in place of the three carinae. Area is as large as a third of the flank, and is ornamented with numerous tuberculate costae which are first transverse but oblique later. Escutcheon is narrow, and provided with numerous slightly tuberculate costellae. Median furrow is shallow but rather distinct (see pl. 24 fig. 6).

In the succeeding middle stage, 50 60 mm. in length and 45 50mm. in height, the shell becomes ovate to triangularly ovate in shape and the beak is shifted at about three-tenths to a third from the anterior end. The height-length proportion is about 1:1.20. There are 12 to 14 diagonal and arcuate nodose costae or rows of nodes on the flank. Carinae and sculptures on the area and escutcheon become obsolete, but the coarse growth-lines are well developed on the area. Shell (L=70–85mm., H=63–70mm.) in adult is ovately subtrapezoidal to triangularly ovate in outline, and ornamented with 15 to 19 nodose costae or rows of nodes on the flank. The height-length proportion is 1:1.10 to 1:1.25, and the beak situated at about a fifth to a fourth from the anterior extremity.

In some internal moulds of the right valve (pl. 20, figs. 3 and 5), it is observed that several grooves and ridges behind the posterior adductor scar are oblique to the margin. This feature is sometimes well observed in those of Steinmannella (Yeharella) japonica (YEHARA) and some forms of the Quadratae, Pseudoquadratae and other sections.

Variation:—As mentioned above, this species has a certain degree of variation. For example, the outline and surface sculpture are not always the same even in specimens of similar size. There is a relatively trigonally ovate form (pl. 20, figs. la-b; pl. 21, fig. 2), while the holotype and IKEGAMI and OMORI’S specimen 1957, pl. 3, figs. la-ct have the subtrapezoidal outline. Nodose costae or rows of nodes are somewhat narrowly disposed in the illustrated specimens on fig. 4 in pl. 20 and on fig. 3 in pl. 21, but they are broadly spaced in the others (pl. 20, figs. 1-2; pl. 21, figs. 1-2 and 5). The rows of nodes on the flank are well developed in common specimens (pl. 20, figs. 1-2; pl. 21, figs. 2, 3 and 5). On the other hand, some specimens (pl. 20, figs. 5-6; pl. 21, fig. 1) have nodose costae on the flank. Costation on the area and the escutcheon are usually limited to the earliest stage, but rarely observed in the middle stage of some specimen (pl. 21, fig. 4).

Comparison:—This form is easily distinguishable from the others of Steinmannella (Yeharella) by its subtrapezoidal to triangularly ovate outline and surface costation. As compared with Trigonia transitoria STEINMANN from the Neocomian of South America, this form has a smooth area and more prominent nodes on the flank. Trigonia holubi KITCHIN from the Neocomian of South Africa is similar to this form, but differs by the prominent umbo and the less numerous costae on the flank. Trigonia leana GABB and T. leana var. whiteavesi PACKARD
from the Chico group of the West Coast in North America differ from this form in the more quadrate outline and the carinae and sculpture on the area are more obsolete. Steinmannella (Yeharella) jimboi KOBAYASHI and AMANO from the "Trigonia Sandstone" on the Pombetsu river in the Yubari coal-field of Central Hokkaido has some resemblance, to some specimens of the early adult stage of this species, but the former is represented by a single internal mould. In the outline and the aspect of the area, this species looks like St. (Y) kimurai (TOKUNAGA and SHIMIZU) and its ally in Honshu from Coniacian to Campanian, but the latters have numerous remarkable nodes on the more arcuate and geniculate costation and the area is more broader.

Occurrence—Abundant in the lower and upper "Trigonia Sandstone" from the Ikushumbetsu district, Mikasa-city, Central Hokkaido. Its range is probably lower Cenomanian to middle Turonian or lowest upper Turonian. Comparable specimens were reported from the same group in the Yubari coal-field in Central Hokkaido. This species is commonly associated with a number of Ammonoids and Pелеcypods as listed by IREGAMI and OMORI (1957), NAKANO (1960), and others.

References


KITCHIN, F.L. (1913): The Invertebrate...

Explanation of Plate 21

(All natural size)

Steinmannella (Yeharella) aintana (YABE and NAGAO) p. 141.

Fig. 1. Imperfect left valve (GH. NM. 1083), showing sculpture on the flank. Early adult stage. Loc. an old site of a quarry near the Katsurazawa-dam in Ikushumbetsu, Mikasa-city, Central Hokkaido.

Fig. 2. Gypsum cast of a right valve (GH. NM. 1082). Adult stage. Loc. ditto.

Fig. 3. Gypsum cast of an imperfect left valve (GH. NM. 1091). Adult stage. Loc. ditto.

Fig. 4. Modeling cast of an imperfect right valve (GH. NM. 1092a), showing the sculpture on the area and escutcheon. Adult stage. Loc. ditto.

Fig. 5. Gypsum cast of an imperfect right valve (GH. NM. 1089). Adult stage. Loc. ditto.

Fig. 6. Modeling cast of an imperfect left valve (GH. H. 6046). Immature stage. Loc. MatsuMoto's loc. 2013 along the Pombetsu river in Ikushumbetsu.


